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Front Cover: Good woodland management is an important part of soil conservation. Woodlands support many kinds of useful wildlife. None is more exciting to hunter, nature lover, or cook than the ruffed grouse. The young birds eat many destructive insects.

PHOTO BY GEORGE C. LOWARY.

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CORPORAL ATKINS TAKES OVER

Dedication panel being perused by Chief Bennett.

War Hero, Given Farm by Friends and Neighbors, Maps Strategy for Battle of the Land

By T. S. Buie

"Many others have fought for the same things I did. I don't feel worthy, but with God's help I'm going to do the best I can to make this land better."

IN THAT spirit and with those words, Corporal Thomas Eugene Atkins received a deed to the Thank You Farm bought for him by thousands of South Carolina men, women, and children grateful to the Congressional Medal of Honor winner for his heroism on Luzon.

To Atkins, who is modest about the feat that won for him the Nation's highest award, it is like a fairy story that came true. This slender, soft-spoken, 24-year-old hero is a sharecropper's son, and a sharecropper's life seemed in store for him when he returned from the Pacific.

Led by the country doctor who had been family physician to the Atkinses for two decades, by a village banker, and by the wide-awake publisher of the Spartanburg Herald-Journal, the friends and neighbors of the war hero bought a farm and built a Mount Vernon style cottage on it for him and his bride.

But the South Carolinians did more than buy 62 acres of land for Atkins. They also helped him to get started on a modern soil conservation farming plan that will keep the land productive from here on out. What Atkins is doing to protect his farm from soil erosion should be an inspiration for other veterans returning to the land. Later, there will be more to say about the way he is transforming a typical, eroding Southeastern farm into a model of soil conservation farming. But first let us tell how Thomas Eugene Atkins, as a member of the famous 32d (Red Arrow) Infantry Division, won the Congressional Medal of Honor.

It happened in the predawn hours of March 10, 1945, on the Villa Verde Trail in the Caraballo Mountains of Northern Luzon—a mighty long ways from Atkins' beloved Blue Ridge Mountains.

Atkins and two companions, in a lone perimeter outpost, were directly in the path of a savage at-

NOTE.—The author is regional conservator, Soil Conservation Service, Spartanburg, S. C.

Farm equipment dealers volunteered to establish the seasonal practices on the land. In this newly terraced field, the land is being prepared for the planting of small grain in contour strips. These strips will alternate with next year's strips of row crops—cotton and corn. Annual lespedeza will be overseeded on the grain.

Secretary Anderson warmly congratulates the valiant Gene, as he hands over the ownership papers to the young veteran and his bride.

tack launched by two companies of Japanese. The two companions were killed in this first attack, and Atkins suffered a deep flesh wound through his left hip. Although he could have crawled back to the greater security of the main defense line, Atkins held the outpost against heavy and incessant Japanese attack. He fired more than 400 rounds of ammunition—burned out his own rifle and those of his two dead companions.

Only when his ammunition was gone and the three rifles failed to function further, did Atkins crawl back to the main lines—and then to ask for another rifle. Persuaded to have his wound dressed, Atkins was awaiting evacuation when he twice spotted enemy stragglers. He grabbed a nearby rifle, killed one Japanese, and dispersed a second group.

When dawn came, there were 43 dead Japanese in front of the foxhole the straight-shooting South Carolinian had defended so well. His commanding officer, Col. Frederick R. Stofft of Tucson, Ariz., said that "most if not all of them were undoubtedly killed by his expert and heavy fire."

The Luzon campaign was the third for Atkins. He already was a veteran of New Guinea and the Southern Philippines. That's the kind of fighter Spartanburg County welcomed home.

When Secretary of Agriculture Clinton P. Anderson came from Washington to Spartanburg County November 14 to present the farm deed to Atkins, more than 1,500 persons packed the Gramling School auditorium, notwithstanding the cold, rainy weather.

It was a program that honored Gene and the other service men from the county. And at the same time, it gave emphasis to the battle for the land—the battle against soil erosion and soil depletion.

John G. Landrum, bank president who served as chairman of the "Thank You Farm" purchasing committee, summed up the purposes of the meeting at the outset—

"Corporal Atkins is but a symbol of all Spartanburg County boys. Many others have distinguished themselves, some even making the sacrifice of their lives. Manifestly, we cannot honor all of them this way, but our tribute today is meant for them also. . . . This is also a great day for the farmers of the county. Farm agencies representing the basic interest of the farmer have made their contribution to the improvement of agricultural methods in this region. For this work we are indebted to the Broad River Soil Conservation District and the agencies cooperating with it—the Soil Conservation Service, the Extension Service of Clemson College, the vocational teachers and their students, and the State Forestry Commission."

When Chief Hugh Bennett of the Soil Conservation Service spoke, he stressed the fact that "this is not our show." Said he—

"It was Thomas Eugene Atkins, who was too tough for the Japs to lick, who came home with his heart set on farming, and who decided to farm this new place of his the safe, conservation way. It is Atkins, his South Carolina neighbors, and tens of thousands like them in the other 47 States who are going to safeguard our country's agricultural land from this other enemy—unnecessary soil erosion—and keep it permanently productive."

The Secretary of Agriculture told Atkins and the audience: "You must continue your great soil conservation work, for according to all signs—unmistakable signs—the South is on the threshold of an industrial-agricultural revolution that may shake its economy right down to the cotton roots on Gene's farm. . . . Gene, I'm happy as a member of the President's Cabinet to hand you this deed to Thank You Farm. May God bless you, Gene, as this community has blessed you."

The war hero replied: "I want to thank Dr. Walden and all those who made this possible. Thanks for making my dreams come true. I'm going to do the best I can to make this land better."

The farm plan became a part of the cooperative agreement between Atkins and the Broad River Soil Conservation District. It is obvious that the plan thoroughly pleases Atkins and District Supervisor E. C. McArthur.

Dr. A. R. Walden, to whom Atkins referred, is the country doctor who wrote to Publisher William A. Townes of the Spartanburg Herald-Journal:

"Editorials and medals are fine, but they will not help him greatly in earning a living after the heat of war is over. My proposal is for a number of us to show our appreciation by buying him (Corporal Atkins) a home."

Dr. Walden enclosed with his letter his check for $100. Townes liked the idea, added $100 of his own money and $100 for the newspapers to help buy a Thank You Farm. Radio Stations WSPA and WORD of Spartanburg joined the campaign.

Supervisor E. C. McArthur of the Broad River Soil Conservation District read the story about Thank You Farm and offered the services of the district in helping to select and plan the farm for soil and water conservation. Chairman Landrum accepted McArthur's offer, because, as the Landrum bank president expressed it, "We want him to have a good farm, and then to give him all the help possible in keeping the land and making it better."

As the Thank You Farm campaign started, Atkins was married to Vivian Rollins, the farm girl with whom he used to pick cotton and who had accepted the proposal he had writen from the Pacific.

Then Atkins, his bride, and his parents, Mr. and Mrs. Cleve Atkins, went to Washington. There the hero received the Congressional Medal of Honor from President Harry S. Truman and was promoted to corporal. The president told the sharecropper's son, "I'm glad you are a farmer and will have a farm of your own. I was a farmer myself."

By the time Atkins returned from Washington and had received an honorable discharge from the Army, $7,500 was in the bank for Thank You Farm. Most of the money came in quarters, half-dollars and dollars from individuals who wished to share in honoring a hero.

Working on plans for the big day: Edgar A. Gwynne, left, and William A. Townes, officials of the Spartanburg (S. C.), Herald-Journal.

PHOTO BY MILDRED SCRUGGS.

In the meantime, Soil Conservation Service technicians at the request of District Supervisor McArthur had made soil conservation surveys and land capability maps on all the farms offered for sale to Chairman Landrum and the farm buying committee: Townes, County Agent Joe Frank Jones, Charles O. Hearon of the Herald-Journal staff; Otto Marlow, a farmer, and Cliff (farmer) Gray of Radio Station WSPA.

After studying the colored maps and hearing Atkins say he wanted a cotton, corn, small grain,

and livestock farm, the committee chose a 62-acre farm 6 miles from Landrum, S. C.

Typical Piedmont land, this farm needed a complete soil and water conservation program to keep it productive.

J. H. Talbert, district conservationist assigned by the Soil Conservation Service to the Broad River District, worked with Atkins in making the conservation farm plan, as reported by Hugh Bennett in his article in the January issue of *Soil Conservation*. Careful consideration was given to two factors: (1) The best possible use for each field, as shown by the land capabilities map and (2) the type of farming that Atkins wanted to follow. For example, it was necessary for the farm to produce enough feed for the livestock on the place. Two mules had been given to Atkins by a bottling company. Atkins said he wanted to keep 4 or 5 cows for milk and butter, 3 or 4 hogs for meat, and about 100 laying hens for chickens and eggs.

The best land was planned for cultivated crops—cotton, corn, small grain, and vegetables for home use—but because of the slope and the active erosion, intensive soil conservation treatment was needed. These practices included terracing, a meadow drainageway and other disposal areas to receive terrace water, contour tillage, contour strip crops, and a conservation crop rotation that included annual lespedeza for soil improvement.

Trees will be kept on the steepest land. The woodland, with selective cutting and protection against damage by fire and grazing, will provide all the wood needs of the farm.

Other steep land, which has suffered extensively from erosion, can be used for hay and grazing. These areas will be planted to two perennial legumes, sericea lespedeza and kudzu, widely used in the South for erosion control, soil improvement, and forage.

The best pasture land on Thank You Farm is low and wet. It will be cleared of worthless trees and brush and planted to grasses and clovers.

Even wildlife conservation is included in the new farm plan. A 30-foot border between the woods and the cultivated field—an area where crops usually fail because of shading and sapping by the trees—will be planted to sericea and bicolor lespedeza to give food and cover to small game.

There was one other thing that Atkins told Talbert he had his heart set on—a fish pond. At one end of the grass-clover pasture, they found an ideal site for a 1-acre pond. When properly stocked with fish and fertilized, this pond should supply 200 to 250 pounds of good eating a year—as well as a lot of fun.

By the time Secretary of Agriculture gave the deed to Thank You Farm to Atkins, most of the practices that could be placed on the land during the fall of the year had been established. Farm equipment dealers and agricultural agencies cooperating with the Broad River Soil Conservation District built the terraces, sowed small grain in alternate contour strips, shaped and seeded the meadow drainageway, set pine seedlings in the cut-over woodland, planted kudzu, prepared the wildlife border, and sloped the road bank for a 15-foot border strip to be planted to sericea lespedeza.

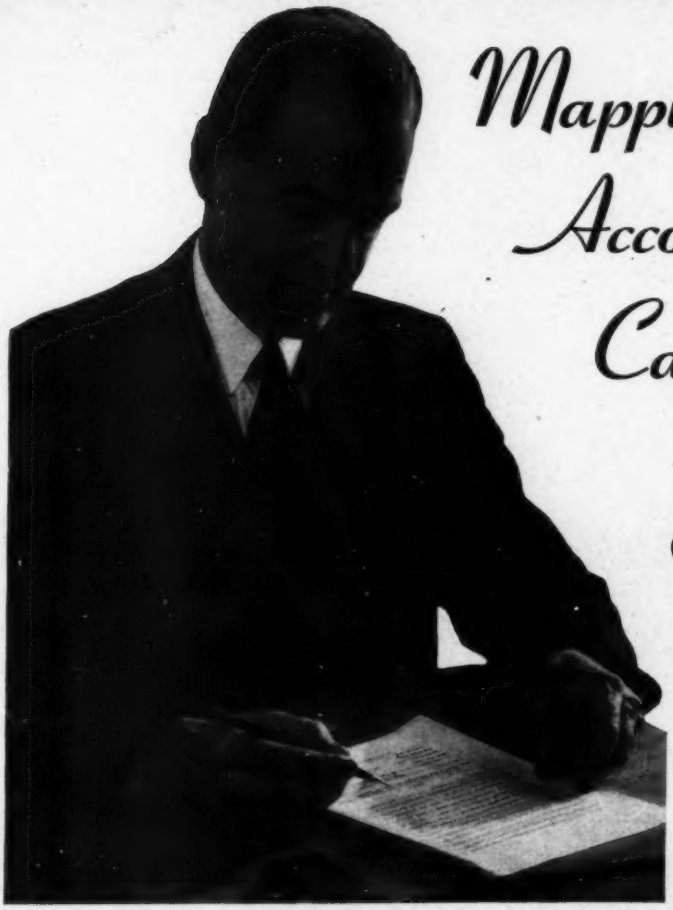
As Landrum explained, "We have given Atkins a farm and we have helped him to get started on a soil conservation program that will keep the land productive. Because every one will watch the way he farms his land, we believe that his soil conservation farming will be an inspiration and a demonstration for all the other farmers of our section."

The technical help Atkins had in planning his farm for soil and water conservation is now available to veterans—to all farmers, in fact—in more than 1,260 farmer-organized soil conservation districts that cover almost 700 million acres in 45 states. The districts are not in a position to get the practices established, as Broad River District did in the special case of this war hero, and the farmers themselves do the work. But AAA payments help to pay for the establishment of many of the measures. County agents, vocational agriculture teachers, and Soil Conservation Service technicians can tell veterans how to get in touch with their district supervisors.

And when veterans start soil conservation programs on their lands, they will be defending their country as surely as they did when they fought to protect it from foreign aggression. That's what South Carolina's Thomas Eugene Atkins is doing on Thank You Farm. Moreover, he expects to increase acre yields by at least 34 percent. Other South Carolina farmers have reported such an increase as a result of soil conservation.

Dr. H. W. Reuszer, soil scientist in research, Soil Conservation Service, Auburn, Ala., has received the OSRD Certificate of Merit for studies relating to deterioration of military equipment by tropical bacteria and fungi.

Mapping the Land According to Capability



By Dr. Firman E. Bear
Chairman, Soils Department
New Jersey Agricultural
Experiment Station

Dr. Bear

THE Soil Conservation Service is now in the process of resurveying the soil resources of the Nation in terms of what is known as land capability. This paper has to do with the meaning of this term and the use to which the information gained by such a land classification can be put.

The soil conservationist is concerned not only with the tremendous over-all problem of conserving our land resources but also with the very pressing problems presented by soil erosion on individual farms. In developing the conservation program it soon became apparent that the original soil surveys which had been made on a 1-inch-to-1-mile basis, were inadequate to meet the requirements. A more detailed map was needed that would show not only the distribution of all the important soil types, but would indicate the slope of the land and the kind and degree of erosion that were involved. Accordingly, a resurvey is now being made on a 4-inch-to-1-mile basis, which means multiplying the older map area 16 times.

Soon after this resurveying program got under way it became apparent that it provided an opportunity to break the generalized soil types down into smaller units that corresponded more nearly with the farmer's experience in dealing with the several parts of his individual fields. At first the tendency was to differentiate the soils into as many

NOTE.—This paper was presented at the Third Annual Conservation Conference, held under the auspices of the New Jersey State Soil Conservation Committee, Medford Lakes, N. J., October 9, 1945.

units as could be detected by field inspection, no matter how small the differences might be. Now, however, the survey is being based on only those factors that appear to be of considerable importance in differential practice. Even so, the resurvey is giving us from three to four times as many soil types as were mapped in the original survey. Furthermore, as would be expected with the passage of time and the gathering of more information about the soils of the several States, some of the original series names have had to be replaced with new ones that are more in conformity with usage in other areas.

The multiplication of the number of soil types presented complications for men of limited memories, even when considered for a single county. But this was a relatively minor problem when compared with the one that developed when 6 classes of slope and 10 classes of erosion were introduced into the scheme. Thus the magnitude of the memory problem had been multiplied at least 200 times.

In order to overcome this difficulty it became necessary to group the various factors that determined the seriousness of the conservation problem into more practical units. Thus, two fundamentally different soil types, when considered in relation to their slope and erosion classes, often fell into the same conservation category. By continued study of this problem it became apparent that all soils could be grouped into a relatively small number of land-capability classes. The classes that were to be differentiated ranged from the most widely adaptable one, in which the land was so favorably situated and of such quality that practically no physical problem in land use by cultivation procedures was presented, to the worst one, in which the land was considered unsuited for anything except what a protected nature would provide.

In accordance with this concept, all land is now being placed in one of eight land-capability classes. Of these, seven classes fall into two major groups, the differentiation between them being made on the basis of their suitability for controlled cultivation. The division into classes within the group is based on the ease with which erosion can be controlled. Selecting the slope factor as an example, land in group A, classes I, II, III, and IV, would normally be described as flat, gently rolling, rolling, and hilly, respectively, and that in group B, classes VI, VII, and VIII, would be described as steep, mountainous, and cliffs (or swamps), respectively. Range land has been set apart from the others and designated as class V.

Once a farm is mapped in accordance with these land-capability classes, the farmer and his advisors are then in a position to plan a forward-looking program. In border-line cases, however, it may be necessary to go back to the field in order to determine the seriousness of the risk of endeavoring to utilize the land for a farming program that calls for more cultivation than is deemed advisable for that class of land. Thus, length of slope, roughness of topography, and exposure to wind are not shown on either the land-capability maps or on the soil survey maps which the land-capability colors overlie. The technical man, of course, can read a great deal more on these maps than the untrained.

In general, the greater the amounts of class I and class II land on a farm, the more intensive the farming enterprise may be, and the greater the permissible expenditure for machinery and labor. In proportion as more class III and class IV land is found on the farm, the more extensive the agricultural enterprise would normally be. In other words, land values and acre-incomes tend to drop and larger land areas are necessary for adequate labor incomes in the higher-numbered land-classes.

The mere fact that land is placed in one of the higher classes, however, does not mean that it is ruled out as to potentialities for profitable farming. In fact, the possibilities are quite the contrary for men of adaptability. An example of the realization of such possibilities is provided by a well-known New Jersey farmer who is now operating, in an adjoining State, some 2,000 acres of land belonging largely to classes IV, VI, and VII for raising heifers for dairy-herd replacement, for growing Christmas trees, and for the production of timber.

These three enterprises operate on three different time schedules, the heifers moving into milk production at about 27 months, the Christmas trees going to market on an 8- to 10-year schedule, and the timber requiring from 35 to 40 years.

More specifically, this enterprise is based on the stated policy that no large area of land will be added to the present holdings if it has important potentialities for cultivated crops. Operating on

that basis, most of the land has been purchased from about $7 per acre, without buildings, to around $15, with buildings. A recent acquisition, consisting of 160 acres with an excellent frame house, a good barn, and several fair outbuildings, was purchased for $2,500, or a little over $15.50 per acre. The reason this land can be purchased at such levels is apparent, in that it indicates that the use to which it had previously been put was not a profitable one.

Having purchased such a farm, the class IV and some of the class VI land is set aside for hay and pasture, and the remainder of the class VI and all of the class VII land is put into trees. The cost of producing Christmas trees on such land is estimated at $300 per acre, over a 10-year period, and the selling price of 2,000 trees per acre, out of 2,500 that were planted, at $1,000 per acre, at the end of a 10-year period, giving a net return of $700, or $70 per acre per year.

This discussion naturally leads to a consideration of two very important points, one having to do with the uses to which land-capability maps can be put, and the other with the problem of education of the public toward improved use of land.

Considering first the possible uses of land-capability maps, it is readily apparent that they have great value both to the farmer and to those who advise him. But it is well to keep in mind that they will ultimately be widely used in farm real-estate transactions as the basis for evaluating the potentialities of the land for the purposes the new owner has in mind. Thus the first thing any man who wants to buy a farm should do is to go to the soil conservationist's or county agent's office and examine the land-capability map of that farm. But land-capability maps will also find highly important uses in evaluating land for taxation, for credit purposes, in condemnation proceedings, when damages are incurred as a result of highway construction or other public improvements, and for a great variety of other purposes. One cannot contemplate these possibilities without realizing how much depends upon having this job of classifying land according to its use-capabilities rightly done.

The second problem, that of educating the public to the end that profitable use is made of all land, is of even greater importance. Thus we need not only to conserve properly the better cropland, but also to open up the minds of men to the long-range potentialities of land for forest, recreational, and game purposes, all of which enterprises can be made to stand on their own feet. It is my considered opinion, growing out of a careful study of what the Soil Conservation Service is doing in the way of mapping land as to its use-capabilities, that this is one of the most far-reaching enterprises in its potentialities for public good that has ever been undertaken in this country.

FROSTED KUDZU

By B. H. Hendrickson

ACCORDING to preliminary chemical analyses made of a full growth of kudzu collected as hay just before frost, kudzu is high in fertilizing value. It is rich in nitrogen and contains considerable phosphoric acid and potash. O. W. Beale's analysis, made at the Conservation Experiment Station laboratory at Clemson, S. C., in 1945, of sample sent to him from this Station, was partly as follows:

Nitrogen	3.18%
Phosphoric Acid	.54%
Potash	1.00%

On average land, a full season's growth of well fertilized and well established kudzu produces in excess of 5 tons per acre of air-dry hay. This does not include the large vine runners close to the ground, which root at the joints. On this basis, 10,000 pounds of kudzu hay contains 318 pounds elemental nitrogen, 54 pounds of phosphoric acid, and 100 pounds of potash.

By comparison with commercial fertilizers, this is equivalent to one ton of nitrate of soda at present prices costing $38.50, 300 pounds of 18% superphosphate worth $2.75, and 165 pounds of 60% muriate of potash worth $4.00—or a total fertilizer value of over $45.00 per acre.

After weathering in the field until the following March, the kudzu residue or "frosted kudzu" analysed as follows:

Nitrogen	1.78%
Phosphoric Acid	.46%
Potash	.12%

In other words, the smaller portion of the kudzu remaining on the land in March still was over

NOTE.—The author is project supervisor, Southern Piedmont Conservation Experiment Station, Soil Conservation Service, Watkinsville, Ga.

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half as rich in nitrogen. It was four-fifths as rich in phosphoric acid, but had lost seven-eighths of its potash.

Kudzu has been called a "nitrogen factory." The high nitrogen content of the hay is mainly in the form of protein—the most valuable of all the feed nutrients. During the winter months, some of this important feed constituent undergoes decomposition and is lost by leaching from heavy winter rains.

Since frosted kudzu has a high feed value, it is a good practice to graze it off during the winter months and thus conserve some of the nitrogen which would otherwise be lost through leaching. It supplies a large volume of palatable dry roughage, readily eaten by dairy and beef cattle. The moist leaves and litter in contact with the ground decompose first, leaving ample rich residue on the ground after grazing to protect it from erosion and improve its fertility, in addition to the added fertility derived from manure dropped by the cattle.

DISTRICT PROFILE

PERCY PERRY, OF KANSAS

WHEN it comes to discussing soil and water conservation, Percy Perry holds his audience with the eloquence of a Chatauqua speaker. And this interest is well founded. Mr. Perry, a member of the Rice County (Kansas) Soil Conservation District Board of Supervisors has had nearly half a century of farming experience. His life has been full and eventful, serving the farmers in Rice County. Born and raised on a farm in the Little River community of Kansas, he started farming his own 160 acres at the turn of this century. In 1911, he was graduated from the Bible Department of Washburn College at Topeka. From there he went on to the Chicago Theological Seminary. Completing his study for the ministry he served as a pastor until he entered the Army in 1917 and went overseas to France. After he was honorably discharged in 1919, he went into the grocery business near home. But all through this period he kept in close contact with his farm, renting it out first, and then farming it himself in connection with his other business. Perry sold his grocery store in 1935 and since then has been devoting all his time to his farm except when occasionally called on to serve in the local pulpit.

It was also in 1935 that Perry noticed the severe erosion taking place on his land. He got in touch with the county agent, M. M. Taylor, who is in the Soil Conservation Service. He wanted to know how to stop the gullying in one of his fields. Terracing was one of the first suggestions made by Taylor. Although no terracing hda been done in

Perry, of Kansas.

Rice County prior to then, Perry was willing to take a stab at it. Taylor laid out the lines and the terraces were constructed with a small grader. They were narrow and had sharp ridges. Although they were not liked too well by Perry, they served the purpose for which they were built,

controlling erosion on the field. During the past few years these terraces have been reworked to broad-base specifications, which Mr. Perry likes much better, and which are easier to farm across. Other terraces have been added to the original ones.

"Ten years ago we didn't know too much about terraces or terrace outlets," Perry comments. "We've learned a lot about them since. The first outlets I built didn't have a cover of grass and gave me some trouble. But that has changed. I now have plenty of grassed waterways providing adequate outlet for the water.

"For 17 years prior to conservation farming wheat yields averaged 12 bushels to the acre. Terracing and contour farming on 150 acres, in recent years have brought the yields up to 22 bushels per acre."

Mr. Perry at present owns 560 acres, 3 miles north of Little River. He worked out his farm conservation plan with the help of Soil Conservation Service technicians. It calls for terracing and contouring of an additional 175 acres, the balance of his cropland. He uses sweet clover in rotation on this land, seeding one-fifth of the cropland to legumes each year.

"It takes a little more time to farm on the contour with terraces but you save a lot of soil and water that way. And you save the necessity of replanting crops. The increased yields more than compensate."

Some of Perry's eroded acreage has been taken out of cultivation and seeded to grass. He built a stockwater pond in his 160-acre pasture and has a crop residue management program.

"Conservation farming has helped me produce the best crops I've grown on this farm in the past 40 years," Perry added. "It isn't what a fellow *says* about soil erosion and conservation, it's what he *does* to control soil losses that counts.

"The real issue at stake everywhere is this: Shall this be a prosperous community or a poor one? Financial, social and political stability of a community directly depend on how well the soil is taken care of. We have two roads to follow, one of protecting the soil and maintaining a prosperous community, or one of neglecting the soil and some day winding up on the ragged edge.

"Soil is basic. For a long time we did not realize it. If soil erosion is allowed to continue, it will permanently damage us all both economically and socially. Our descendants in generations to come will find the struggle for a livelihood increasingly difficult."

This same philosophy was behind Perry's help in organizing the Rice County Soil Conservation District in 1943. He showed avid interest and helped organize the district, which he described as, "an organization set up to help farmers with their erosion problems and, in turn, help the community."

Mr. Perry also has emphasized the way conservation farming helps control the high crests of flood, saying "The only permanent long-time solution of this flood problem is to hold the water on the land where it falls. That should be followed with small dams and reservoirs with the idea of developing these facilities for recreation and recharge of ground water."

With his years of farming experience and deep devotion to whatever will benefit Kansas agriculture, Percy Perry supplies an example of the sort of farm leadership that is doing so much to spur the work of soil conservation districts in the midwest.

SOIL DETACHMENT AND TRANSPORTATION

By W. D. Ellison

A CERTAIN definition of soil erosion has always seemed helpful to me in the study of soil erosion problems. This definition appeared in the September issue of *Soil Conservation*, in my article "When Raindrops Splash." It stressed the fact that soil erosion consists of two distinct processes. There are "(1) displacing or tearing the soil loose, and (2) transporting the soil material." Substitute the word "detach" for the phrase "displacing or tearing the soil loose." Your definition then will read: Soil erosion is the detachment and transportation of soil materials by erosive agents. The erodibility of a soil by water will then depend on (1) those properties that cause it to resist detachment by water from the soil mass, and (2) those properties that affect its transportation by water.

The resistance to detachment of particles from the soil mass will depend mainly on the soil's cohesive properties. A soil that has a high clay content may have strong cohesive properties.

NOTE.—The author is assistant chief, division of drainage and water control, Soil Conservation Service, Washington, D. C.

(Continued on p. 190)

Growing Pains of Pond Management

All good fish should reach a frying pan or oven.

By VERNE E. DAVISON

The "big one" is an occasional reward, never dependable.

THERE are dozens of ways to mismanage fishing waters and, with little exception, those wrong technics are more complicated and more difficult than the few essential practices which produce good fishing.

During the period of a single year, July 1, 1944, to June 30, 1945, it was my privilege to approve applications for fish for 1,374 ponds whose owners were encouraged in pond management for fish by soil conservationists in the Southeastern Region of the Soil Conservation Service. I wish I could say, "Those 1,374 ponds will demonstrate successful fish management"; unfortunately, at least three or four hundred of them will not provide the owners with good fishing until they manage them properly.

We've been studying dozens of ponds that were constructed, stocked, fertilized, fished, and otherwise managed as a part of the soil and water conservation activities of farmers who are cooperators in soil conservation districts. Soil conservationists have had their doubts relative to this or that technic recommended by the regional biologist. That's reasonable—they're entitled to doubts until they have living proof in their own work territory; but the time for mistakes and doubt has just about run its course in the Southeast. Almost every technician who began pond work as long as 2 or 3 years ago, now has one or more disheartening examples to compare with more recent successes.

Introducing a new set of water management technics certainly has its trials. Our technicians encounter the full barrage of questions and arguments about fish management—for old ponds as well as new. A few folks honestly admit, "I don't know anything about managing fishing waters, but I like to fish." You would think, however, from the freely given advice handed out over the counter and from the barber's chair, that a fishing license is generally regarded as a permit for the professional practice of fish culture.

I could not understand the confident manner in which a fisherman walked up to a pond and gazed into its crystal surface (not unlike a crystal ball) and prescribed "a couple of new water weeds, more brush piles, some gravel beds, eight or ten thousand more hatchery-raised fish, a longer closed season, a 13-inch instead of a 9-inch minimum size limit for bass; and a ton of manure and a bushel of daphne at 2-week intervals." Nor can I figure out

NOTE.—The author is chief, regional biology division, Soil Conservation Service, Spartanburg, S. C.

how the same person weighing up potatoes at the store came to suggest, "I'd put some crappie and catfish and top minnows and northern pike in that pond" to the farmer who simply remarked "fishin' ain't no good no more."

It's been fun to dip a minnow seine in the shallow edges of hundreds of ponds from Virginia and Kentucky south to Mississippi and Florida; and show the surprised owners and our own technicians the simple, easy ways to tell what most ponds need in management. Few people really know what conditions exist within their ponds. Everyone seems concerned to protect the little fish from snakes and birds and turtles and bass and the so-and-so who would take anything less than the "big ones." But if there's pleasure in success, there's balancing heartbreak in the failures. If I have failed to find every way in which a pond can be mismanaged, it's probably because I'm only 42 years old. Nevertheless, I am confident I'll see more ways and hear more owners say, "I didn't know. My best friend told me to do it. What can I do now to correct it?"

Offered here is a list of 5 essential things that must be done to have the best fishing in farm ponds. Following these are noted the 16 com-

Ponds in streams are not suitable for fertilization.

A string of medium-size bluegills wins the admiration of all but the size-hungry.

monest practices which at best are an unnecessary waste of effort; while the worst of them will ruin fishing in any pond.

1. It is essential to begin with approximately 100 bass and 1,000 to 1,500 bluegills per acre. A few adults won't do, and no other kinds of fish can be managed very successfully, according to present experience.

2. It is essential to fertilize pond water. Submerged water-weeds and mosquitoes can thus be kept out. Fertilized waters produce a heavy yield of fish, and make fishing more successful. Between 500 and 1,500 pounds of 8–8–4 chemical fertilizer will be required per acre annually.

3. It is essential to protect a pond from becoming muddy and from excess water. Silt prevents economic fertilization; and, since pond management is chiefly water management, a farmer finds fertilization a hopeless task if the pond contin-

ually refills with fresh water and washes out that which has been fertilized.

4. It is essential to maintain a pond free from weeds, grass, brush, trees, and other debris or obstruction. Fishing is more pleasant and more of the fish will be in usable sizes.

5. It is essential that the pond be fished—removing usable fish by hook and line fishing—without regard for spawning season, size, kind, or numbers. The number of pounds removed will govern the number of pounds produced as the food, formerly consumed by those caught, becomes available to those remaining. The fish themselves will limit the anglers' catch, leaving a big margin of safety in breeding stock.

To summarize: *These five essentials will produce excellent fishing without any other measures. To make each pond manageable requires a little common sense when selecting sites and constructing the reservoirs. Management requires a reasonable amount of work and expense to apply fertilizer and control vegetation around the pond edges. It is important, therefore, that effort and thought be concentrated on the essential things—and not dissipated on the unnecessary or incorrect practices,* several of which are listed as follows:

1. Stocking a well fertilized pond with less than 100 bass per acre is wrong. Any southern pond without bass is no good. Stocking with adult bluegill in numbers substantially below 1,000 per acre is wrong (if the pond is to be well fertilized).

2. Stocking ponds with crappie, catfish, or any species other than bass and bluegills is not likely to produce continuous fishing. No combination is as simple to manage as bass and bluegills. Experimental results have proved no combination of fish as successful as these two.

3. Brush and trees in a pond neither increase the fish nor make fishing better.

4. Sand, gravel, or rock piles for spawning are entirely unnecessary. Pond fish will spawn adequately without them.

5. Addition of golden shiners, gizzard shad, top minnows, and other "base food" is unnecessary. The small bluegills and bass provide adequate food and will eat all mosquito larva in weedless ponds.

6. Screens across spillways are dangerous and largely unsuccessful. Little fish washed out even in great numbers are of no consequence—there will be that many more produced. Large fish go out only with deep flows through spillways—a condition avoidable by making wide spillways that spread the overflow thin (no more than 3 to 6 inches deep) and by avoiding flood waters, either by diversion ditches, or still better, by selecting sites on small watersheds.

7. Kingfishers, herons, fish ducks and other birds have no material influence on fish in farm ponds. They eat only little fish of which every pond will have plenty. Only in hatcheries where thousands of fingerlings are kept in relatively little water are such birds undesirable.

8. Planting of water lilies, mosses, or other water-weeds is of course detrimental. More fish are produced in weedless ponds than in those that are weedy.

9. Running water to "keep it fresh" is unnecessary. The plant and animal life together with the sunlight maintains a healthful condition for fish, livestock, and people even in waters remaining without "fresh" water entering.

10. Leaving stumps or putting wire, posts, broken glass and other impediments in ponds to "prevent some so-and-so from seinin' all the fish out" makes wading, swimming, and fishing unpleasant. Very few ponds can be seined heavily enough to reduce the brood stock substantially. Depth is usually sufficient guarantee against harmful seining.

11. Draining a pond down to "dry it out for weed control" is not successful. Weeds that live beneath the surface can be killed and kept out with shade resulting from the dark green coloration of fertilized water; the roots of water-lilies can be exhausted by cutting the leaves as they reach the surface of the water (several cuttings are necessary as exhaustion proceeds slowly); and cattails and similar "edge-weeds" can be kept under control by pulling them occasionally as they appear. Bluestone (copper sulphate), calcium arsenate, and other chemicals are less desirable for weed control as some weeds are not harmed substantially, chemical poisons kill fish foods too, and the "successful" results are but temporary.

12. "Feeding" with stale bread, grain, or other foods is less efficient than fertilizer, and contributes little to the poundage of fish when fed in the small quantities usually given. Five or ten pounds of such foods will probably produce 1 pound of fish—to add to the 500 pounds per acre supported in fertilized water.

13. The use of manures, cottonseed meal, hay, or other organic fertilizers is not so successful or

productive of fish as inorganic chemical elements. Organic materials support the undesirable pond scums.

14. Closed seasons or "protected areas" are quite unnecessary in conservation of pond fish. In fact, the spawning beds of bluegills should be located and fished heavily if a high yield is to be harvested. It is foolish fear to refrain from catching fish whenever they will bite.

15. It is not necessary to fish the bass and bluegills in proportion to the original stocking for the purpose of keeping a balance. The bass will maintain a correct balance whether the owner takes only bass or only bluegills. To enjoy full use and to harvest the usable surplus, however, both bass and bluegills should be fished; the possible yield is approximately 3 pounds of bluegills for every pound of bass.

16. A narrow belief has been built up by contests and sports-lore that "catching the big ones" is the foremost (and, to some, the only) objective of fishermen and fish producers. To a size-hungry fisherman, one should suggest the Gulf of Mexico or either of the two oceans bordering the United States. Now that pond owners know how to produce more fish it is time to recognize as "master fisher" those who can produce the most pounds of fish per acre, and catch delightful strings of fish frequently. Most people like small pan fish, and like to catch them, too, if the braggart and the contest winner don't bully them into embarrassment.

THIS COUNTY SUPERINTENDENT IS A SOIL CONSERVATIONIST

By Oliver J. Muser

FARMING may be considered a man's game, but Miss Ollie M. Swanson of Sparta, Wisc., has proved that the horny-handed sons of toil have no monoply on it. She has also demonstrated beyond a shadow of doubt that women can do a lot to advance the cause of soil and water conservation. The war gave her the opportunity.

When the county superintendent of Monroe county entered the armed service, Miss Swanson took over his job to pinch-hit as acting superintendent for the duration. She was already interested in conservation and had a complete farm plan on her own land. For that reason, Howard C. Hass, Ernest Dupuis and Raymond C. Schenk of the county soil conservation district had no trouble interesting her in a conservation program among the county schools.

But let Miss Swanson tell her own story: "We, as a nation," says Miss Swanson, "vividly see the necessity throughout the country for the establishment of soil conservation practices on the land. We, here in Monroe County, too, saw the necessity of a well-planned educational program in our rural schools. The fact that farm land is being rapidly depleted of topsoil has been an incentive for soil conservation study in schools. We realize that if we are to continue as a prosperous county the future as well as the present farmers must become soil conservation minded. Too, over 90 percent of the people in Monroe County derive their income from the soil.

Janice May Hall, of Portland Center School, won a soil conservation poster contest. Miss Swanson here views her work with satisfaction.

"Since the local Monroe County Soil Conservation District office has been established, a large number of farmers in all parts of the county have

NOTE.—The author is assistant in education, Division of Information and Education, Milwaukee, Wis.

taken advantage of the splendid service being offered by the conservation office personnel, Messrs. Howard Hass, Raymond Schenk, and Ernest Dupuis. As a result of seeing conservation practices established on the land, the boys and girls have become interested in studying about soil conservation practices such as strip-cropping, contour farming, gully control, reforestation and pasture renovation.

"In planning the spring science work unit for Monroe County rural schools, my assistants and I included a unit on soil conservation. In preparing the unit we sought the advice of the technical specialists from the Monroe County Soil Conservation District. We held several meetings to plan our future activities. It was decided to supersede this study by holding two series of meetings, one for the teachers and the other for the students.

"An effort was made to concentrate on the teacher meetings as 'schools of instruction' to present to the teachers a systematic study of the technical information then relating to conservation. Mr. Schenk presented an illustrated lecture showing colored slides made in Monroe County which covered all phases of a conservation program. Both Mr. Hass and Mr. Dupuis discussed those phases in which they were most keenly interested. A sound movie, entitled A HERITAGE WE GUARD, was presented at the beginning of each meeting to familiarize the teachers with the overall importance of soil conservation.

"After the lecture a round table discussion was held between teachers and the personnel presenting the program to clarify any points still in doubt. Many personal examples were cited by the teachers of the work, either on their farms or nearby farms, that are already showing demonstrable returns from the past few years of service given them by the Monroe County Soil Conservation District.

"At the close of the meeting the following materials were distributed to each teacher, who in turn added these articles to the school library: Zeasman and Clarke's Outline, 'Save the Soil' and a bound book consisting of 17 USDA booklets of the most current material available in the various specialized fields of conservation.

"The teachers felt it necessary to have soil conservation as a truly integrated unit. With the helps given, they could plan every class and subject around this formative area of learning. For example, in art the children could express in picture form what they had learned in their conservation course as well as in other class subjects.

"At one of the supervisors' meetings of the Monroe County Soil Conservation District was decided, as an added incentive to the children, that a poster contest would be held and that prizes would be given for those which best portray the theme of soil conservation. The winning posters were displayed later in local store windows of each community to acquaint the people with the work being done in the rural schools by the future farmers in Monroe County.

"The second as well as the first series of meetings was attended by over 99 percent of teachers and upper grade students. The series for the students was aimed toward presenting a general picture of soil conservation through the use of several movies. At each of these meetings Mr. Hass ended the program with a short guessing contest, using the letters in SOIL CONSERVATION to evaluate the benefits derived from the evening's meeting pertaining to conservation. It was gratifying to note the keen interest that was shown by teachers and students who attended either of the two series of meetings.

"At the close of the unit there was a culminating activity in each school which included the parents of the community.

"Those of us who had been instrumental in establishing this program in our rural schools already have witnessed pleasing results. All of us connected with the program dedicate ourselves to the development of an appreciation of soil and moisture conservation in the public schools. The job becomes easier because of the wildfire-like, spontaneous way in which the children are adopting it."

With Miss Swanson's story in mind it is not difficult to understand the enthusiasm which greeted this science unit.

Various culminating activities were planned, including a special program which was presented for the benefit of the Monroe County School Board at its meeting in May. At this meeting the 111 contest posters were exhibited. An original play written by the pupils and teacher of Enterprise School entitled "Conservation Helps the Bartletts" was also presented. In this play a keen sense of the value of soil conservation and its human relationships was ably depicted. This meeting afforded an excellent opportunity for some who had written essays to present them publicly. All in all, the

In this pleasant farm home in Pleasant Valley, near Sparta, Wis., lives Miss Ollie Swanson, who is responsible for opening to the school children of Monroe County new vistas of opportunity for full living on the land.

school board members of this Wisconsin county have good reason to feel proud when they contemplate the soil conservation achievements of their rural schools.

Fifteen cash prizes, ranging from $5 to $1, were presented to the winners of the poster contest. Top honors and $5 went to Janice May Hall, a pupil of the Portland Center School; second place and $4 were awarded Duane Patterson, Elmwood School; third place and $3 were taken by Betty Stark, Central Point School, Wilton; and fourth place and $2 were presented to Beverly Downing, Lower Brush School.

One dollar awards were won by each of the following: Elmer Gernetzka, Jr., Walters School; Donald Shird, Lower Brush School; Bonnie Shird, Lower Brush School; Delores Becker, Hillcrest School, Wilton; Charles Beller, Diamond Valley School, Camp D; Audrey Schenk, Enterprise School; Hazel Lemon, Hill School; Harold Paddock, Paradise School; Lola Creviston, Central Point; Bernice Livangood, Jenkins Valley School; and Jeanette Uselman, Dorset School.

In conclusion, it might well be reemphasized that this program was the result of cooperation between educational leaders and the Soil Conservation Service. By mutual assistance they are striving to save for themselves and for generations yet unborn the precious heritage of soil. Miss Swanson, through her interest and her activities, has proved that county superintendents of schools are vital links in promoting soil conservation education.

DISTRICT TO MANAGE TAX-DELINQUENT LAND

All tax-delinquent land in Huerfano County, Col., that cannot be sold will be turned over to the Upper Huerfano Soil Conservation District.

The plan was agreed upon at two joint meetings of the district supervisors and county commissioners, and will return to the county tax rolls approximately 36,000 acres of land that has yielded no taxes for two or more years.

The district will attempt to increase the land's productivity through erosion control and better land use.

Supervisors of the Upper Huerfano District are W. P. Garritson, president; T. M. Hudson, vice president; Ernest Wadham, Alton Tirey, and Damasco Vijil.

One example of the effect of Hubam clover on crops on the Texas Blacklands. The corn on the right—fifth successive crop of corn on the same land—is but shoulder high on an average man. That on the left, grown in a 2-year rotation with Hubam, is a foot taller than an average man can reach.

Hubam Takes the Texas Blackland

By W. M. NIXON

Deep in a pasture of Hubam clover and Johnson grass.

BLUE lupine has been toasted in the Old South as a queen of conservation. In the Midwest, bromegrass is heralded as a soil-improving handmaiden of farm conservation planners. And crested wheatgrass has given a lift to thousands and thousands of tired acres on the Western Plains.

Now comes Hubam clover, to take over as the high-stepping drum majorette of conservation in the famous Blackland section of Texas. A relative newcomer, this legume—an annual variety of white clover—already has the spotlight and is fast taking the uplift role in crop rotations all over the area.

Any way you look at it, Hubam clover does yeoman service in putting new life into farming on the tight, crusty Blackland. It mellows the soil and lets it drink in more water. It makes the land more resistant to erosion and easier to work, boosts crop yields immensely, and produces top-grade pasture, hay and seed cash-crops. It helps cotton over the root rot hurdle. It is a natural in 2- and 3-year soil conserving and improving crop rotations. And it pays its own way, however it is used.

NOTE.—The author is chief, agronomy division, Western Gulf Region, Soil Conservation Service, Fort Worth, Tex.

Here's one man's testimony of its versatility. It is by H. C. Westberry of the Files Valley community, a cooperator with the Ellis-Prairie Soil Conservation District, who has used Hubam clover on his terraced and contoured fields for several years.

"Hubam clover," Westberry said, "has been my best cash crop for several years. The seed yields range from 450 to 600 pounds an acre.

"My cotton yields," he continued, "have been increased 40 percent, corn by 10 bushels an acre, and oats production is up considerably. And I see very little dead cotton in my fields since I started planting clover."

This Blackland is a narrow, irregular area of about 11,100,000 acres, which had built a reputation far and wide for its richness. The soils are generally clays variable in depth over parent material. Most has been farmed less than a hundred

Hubam clover is a soil-builder. Here it is being turned under. The added organic matter makes the soil easier to work, enables it to absorb more water, helps it to resist erosion, increases crop yields.

years, much of it continuously in cotton for long periods. Most of its organic matter is gone now; it absorbs water slowly and cracks when dry; it erodes easily. The fungus known as root rot has infested a large portion and causes much trouble. A successful legume was needed badly as part of the program to conserve soil and water.

That is where Hubam clover is doing things. Side-stepping root rot by growing early is the distinctive trait that makes it so valuable. The Texas Agricultural Experiment Station reports that at both the Temple and Denton substations crops which follow it are able to resist root rot.

Mrs. Endsley, on the John Scarborough farm near Paris in the North Texas Soil Conservation District, has discovered this too, as have many others. She reports: "The 16 acres where we turned Hubam clover under as green manure produces like new land. No sign of root rot has shown since the clover was planted."

Hubam's record as stock feed is hard to beat. Henry J. Stermer near Rosebud, in the Central Texas Soil Conservation District, and the Warren brothers near Hewitt, in the McLennan County Soil Conservation District, tell about that.

Stermer pastured 6 cows on 5 acres of mixed Hubam clover and oats from early December until the middle of last March—better than 18 cow-months of grazing. And then last summer he cut nearly 7 tons of fine hay from the field.

"The cattle kept in good condition during the winter with very little supplemental feeding," Stermer noted. "That saved a lot in purchased feed."

The Warren brothers' angle is a little different. They didn't have to buy protein feed for their dairy herd last year so long as the Hubam clover hay lasted. That was an important saving.

The way Hubam clover mellows the Blackland soil causes comment. Otis Miles near Mosheim,

Hubam is a cash crop, too. A combine here threshes the seed out of the windrow. The yield was estimated at 550 pounds per acre.

in the Hamilton-Coryell Soil Conservation District, expresses his appreciation.

"Land will break well in August following Hubam clover, while land where clover was not grown usually is too dry and hard to plow," he said. Frank Blair of the same community veri-

fies this, and adds "I think it holds moisture better."

"Water in the terrace channel on the field where Hubam clover was grown was never as deep last year as in terrace channels on the other fields," is the evidence given by Rufe Henson on the Smyth ranch near Groesbeck, in the Limestone-Falls Soil Conservation District.

And to make it official, the Blackland Experiment Station at Temple was able to check up on Hubam's effect on run-off. Measurements taken during a storm last April showed that the run-off from Hubam clover land was a third less than from land planted to oats. Soil losses were less, too.

The hot, dry summer of 1945 gave Hubam clover another severe test around Waxahachie, and it made good. W. G. Ralph, work unit conservationist for the Soil Conservation Service, found that cotton following Hubam was affected little. But cotton on adjacent fields turned yellow, wilted, and shed a great deal of fruit.

The soil where Hubam clover had been grown was in much better physical condition than in nearby fields not so treated, Ralph reported. Root rot was almost absent from the Hubam fields, but widespread in the others.

Right now, Hubam clover is a glittering cash crop. The good seed yields are general, with 400 to 500 pounds per acre common rather than the exception. At 14 cents a pound—the current price—that is a return of $56 to $70 an acre.

Some of this comes from poor land, too. Witness the experience of W. T. Arnett of the Union community, in the Hamilton-Coryell Soil Conservation District. He had 5 acres of Hubam clover, half of them "as poor land as any on the place." The clover on the poor land yielded better than anything else he had planted there. Of course, the good land yielded better.

The effects of Hubam clover on other Blackland crops is almost beyond comprehension, as a result of the nitrogen and organic matter it adds to the soil. Just a couple more examples: Rufe Henson declares the cotton yield on his field where Hubam had been grown was double the yield anywhere else on the ranch. And Alfred Ballman near Riesel says his cotton yields have risen to 240 pounds from 135 pounds of lint per acre, with corn yields jumping to 34 bushels from the former yields of 22 bushels an acre.

Hubam clover's rise to the glamour spot in conservation crop rotations in the Texas Blackland seems sudden, but it came after a slow start. As early as 1933, Soil Conservation Service technicians and the SCS Blackland Experiment Station were advocating its use. A few acres here and there succeeded; they formed the nucleus that furnished seed when the rush started.

In 1939, soil conservation districts which now include nearly all of the Blackland, took the lead in promoting Hubam clover's use. It was needed to relieve the chronic ills of the tight soil, and put new life into it. Its use in late years has been limited only by the seed supply.

From only a few thousand pounds of seed a few years ago, the crop has grown until in 1945 it amounted to about 3,000,000 pounds in the Blackland area. In 1936, W. J. Hamm near Red Oak, in the present Ellis-Prairie Soil Conservation District, planted 6 acres of Hubam clover—the first in the area; in 1945, there were 20,000 acres planted in the district. That is the way it is all over the Blackland.

The Blackland Experiment Station reported as early as 1943 that "in the past it has been considered economically unsound to devote a crop year to the production of a soil-improving legume. Hubam clover, at the present time, can be considered a cash crop as well as a soil-improving legume. In addition to producing as much cotton in 1 year as continuous cotton produced in 2 years, the Hubam * * * produced an average of 352 pounds of seed per acre."

Thus, Hubam clover has won its favored spot on its merits. Together with terraces, contour farming, crop rotations and other practices, it rounds out the coordinated conservation plans on the Blackland. It appears destined to be the "added something" to lead the Blackland on the road back.

And it promises to add further to its conquests, also, for farmers in the Grand Prairie, West Cross Timbers, Rolling Plain and Rio Grande Plain sections of Texas are finding Hubam clover to their liking. It fits well into their cropping and grazing systems.

Individual farmers, district supervisors, business men are discovering the value of *Soil Conservation* Magazine, with the result that the number of subscriptions has doubled in less than a year. Price, $1 per year. Orders go to the Superintendent of Documents, Government Printing Office, Washington 25, D. C. A discount of 25 per cent is allowed on orders of 100 or more subscriptions going to a single address.

REVIEWS

SOIL EROSION IN NEW ZEALAND, A GEOGRAPHIC RECONNAISSANCE. By Kenneth B. Cumberland. Issued by the Soil Conservation and River's Control Council and printed by Whitcombe & Tombs, Ltd. 227 pages and inset maps, 60 plates and figures. Wellington. 1944.

This is an outstanding book that may well come to take its place as a classic in the field. Beautifully illustrated, well-furnished with tables, charts, colored maps, a comprehensive bibliography, and an excellent index, the work is certainly one of the best surveys that has been issued in any country.

The severity of erosion problem in all its details is very clearly and graphically set forth. "Not less than 28 million acres in the Dominion and possibly many more," says Mr. Cumberland, "are inflicted with the disease of culturally accelerated erosion to a degree which justifies national concern. This is more than two-fifths of the area of the Dominion, and more than two-thirds of the area in occupation."

Arable agriculture, as the report shows, plays but a small part in the farm economy of New Zealand. About 75 percent of the occupied area is in pasture or grassland, and 16 percent in forest or brush. Practically the whole country was forested originally, and the land surface is generally rugged, broken, and steeply sloping. To turn a great forest into grassland and keep it that way, on a sharply inclined and corrugated land surface is what the New Zealanders have tried to do. Fire and grazing have been used for the job, and since neither has been controlled to any great extent, the wholesale removal of vegetation has laid open the soils to the elements. Rainfall is heavy—almost three-quarters of the islands get more than 60 inches a year. And so erosion has taken a heavy toll.

To one accustomed to the kinds of erosion we have in the United States, many of the unusual or unique types present in New Zealand are startling to say the least. Sheet erosion, wind erosion, gully erosion—these are familiar enough to Americans. But wholesale slipping of mountain sides, soil flowing, mass movements, subcutaneous tunnelling, slumping, earth creep, mud flows, shingle slides, and explosive avalanches are something less well known to us, at least on a wholesale scale. These forms of erosion, uncommon in America except in local areas, cannot be described here, but one example of fluid earth flowage accompanied by an explosive avalanche is worth quoting. Picture the scene:

"At Parihauhan * * * a steep (48 percent) hillside rising 600 feet at uniform grade from a log-strewn raupo swamp * * * lubricated the slipping surface of the rock below the soil. Further intense warm front rains saturated the surface soil, making it a fluid mass * * *."

"At the stage when * * * large parts of the hillside were rendered unstable, sod, soil, and subsoil over half acre areas of the slope slid downhill. Tension cracks developed as the sod tore apart at the head of the slip. Lower down * * * a turf roll or toe was built confining a mass of liquid mud * * * the toe swelled until it burst and poured forth a heterogeneous welter of water, mud, and turf * * * down the slope. This mud avalanche * * * bent over young manuka in its path * * * built sod levees down its margins, and spread out a fan of yellow soil and broken turf over the easier country and * * * into the swamp. Sheep were caught, held, and sometimes buried * * *."

The plates portray the wholesale nature of this and other startling types of erosion characterized by large-scale slumping, slipping, and flowing. As the author says, "Many of the forms are rare outside New Zealand: A few appear to be almost unique and for some no counter measures have been worked out. New Zealand has its own special problems * * * for these, New Zealand solutions must be found." As he notes, the United States Soil Conservation Service has devoted the greater part of its research to erosion prevention "in the vast areas of tillage agriculture, and more expecially, in the areas of disastrous row-crop cultivation." But terracing, contour plowing, strip cropping, crop rotations, cover cropping and similar techniques have but limited application in New Zealand. Research and demonstration of the effective techniques discovered are urgently required.

The wealth of information in the 227 pages of this book is impressive. Mr. Cumberland takes his time and builds his case with care. Region by region he discusses the land of New Zealand, its original vegetation, the history of land use, present uses of the land, the extent of erosion, the types of erosion, the geology, and so on. For 109 pages he considers these matters in a clear and scientific way, and then in a large table he provides a summary for each and all of the seven erosion regions into which he has divided the country. The book moves to completion through smaller sections on suggested regional policies, the general needs incident to a soil conservation program, and the wider implications of soil conservation. Four appendices of considerable length treat the relation between erosion and geology, climate, soils, natural and cultural vegetation. A fifth appendix contains a résumé of the New Zealand Soil Conservation

and River's Control Act of 1941. A glossary, selected bibliography, and index concludes the volume.

The maps in this work deserve special mention. Most impressive is a colored map folded in the back cover, and measuring 16 by 20 inches. The main figure shows the cultural vegetation and land utilization in 11 colors. Insets show primitive vegetation of New Zealand in 1840, rainfall, relief, locations, and forest types. This large map is reprinted from the Geographical Review (31:4 Pl. II, 1941). A black and white fold-in map facing page 212 shows the geology of the two islands, and other full-page maps show soils, frost frequency, arable lands, seasonable distribution of precipitation, annual rainfall, erosion regions, and the like. Together with 60 plates, admirably calculated to portray erosion conditions in New Zealand, the completeness of illustration is remarkably good.

It is too bad that the plates are not linked closely with text descriptions. The reader must therefore spend time trying to find the pictures that go with the phenomena he reads about. The glossary could also be improved for readers who are not New Zealanders if it carried explanations of the many Maori names for trees and other objects not always defined in the text. Laymen will occasionally find some of the material heavy going, but not so much so as to detract seriously from the readability. Figure 1*a* and 1*b* lack legends for large portions of the islands—but these are not serious faults.

As far as this reviewer can find, this excellent book is not easily purchased in the United States. Bookstores do not carry it and there is a certain amount of red tape associated with ordering it. This state of affairs is not peculiar to this book, but to many books published outside this country. Nevertheless, the soil conservationist who keeps up with what is going on in the world will do well to order a copy if his personal library is to contain those works that mean the most in the great soil conservation movement.

—*William R. Van Dersal.*

DETACHMENT AND TRANSPORTATION

(Continued from p. 179)

A soil that has a high clay content may have strong cohesion between particles. This cohesion causes the particles to resist separation and it may be so strong as to reduce rates of erosion. However, after the fine clay particles are once detached, they are easily transported by flowing water. They are so easily kept in suspension that it may take them several hours or even several days to settle out of standing water.

In contrast with a clay soil, a sandy soil which contains very little colloidal material will exhibit only small amounts of cohesion between the particles. Its particles, therefore, will be easily detached. However, sands are more difficult to transport than are clays. And so, erosion on a sandy soil will be restricted not so much by the work required to detach the particles, but more by the difficulties of transporting these materials in the flowing water after they are once detached.

Such differences in soils will have a bearing on land use practices for controlling erosion. The erosion control practices most effective in preventing soil from becoming detached will not always be the most effective practices for curtailing soil transportation. Experimental evidence has shown that the principal source of energy which causes soil detachment, at least outside the gullies is raindrop impact, while the principal source of energy which causes soil transportation is surface flow. With these facts as a guide, one should be able to determine from examination of the soil and field conditions what measures will be most effective for controlling erosion; whether, for example, a mulch or vegetative cover on the one hand to check soil detachment by raindrop impact, or contouring and terracing, on the other hand, to impede soil transportation by surface flow.

DAVE DIGS IN

This is how a war veteran, partially disabled and unable to follow his pre-war occupation, made his own niche in peacetime production.

Dave McVickers returned recently to his home in Brown County, Kan. From the Soil Conservation Service he learned that to protect agricultural reseources Kansas farmers would have to put 818,000 miles of terraces on their land. Dave figured he could do a lot of contracting.

Dave talked over his plans with the local banker. A loan enabled the purchase of necessary equipment. Dave also talked to farmers cooperating with the Brown County Soil Conservation District. Terracing jobs were lined up and advance payments obtained. With close to $2,000 he bought a wheel tractor, a 2-bottom 18-inch plow, a tumblebug, and a pick-up truck.

Dave is now building the terraces even better than standard specifications for $80 per mile plus $3.50 per hour for making fills. At these prices he did $1,200 worth of business in the first 60 days. He's already contracted for enough work to keep him busy at least a year. The equipment is being used 16 hours every day for building terraces when the land is in good shape, and on wetter days for custom plowing.

REFERENCE LIST ☆☆

Compiled by William L. Robey, Printing & Distribution Unit

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[1] From the Superintendent of Documents, U. S. Government Printing Office, Washington 25, D. C.

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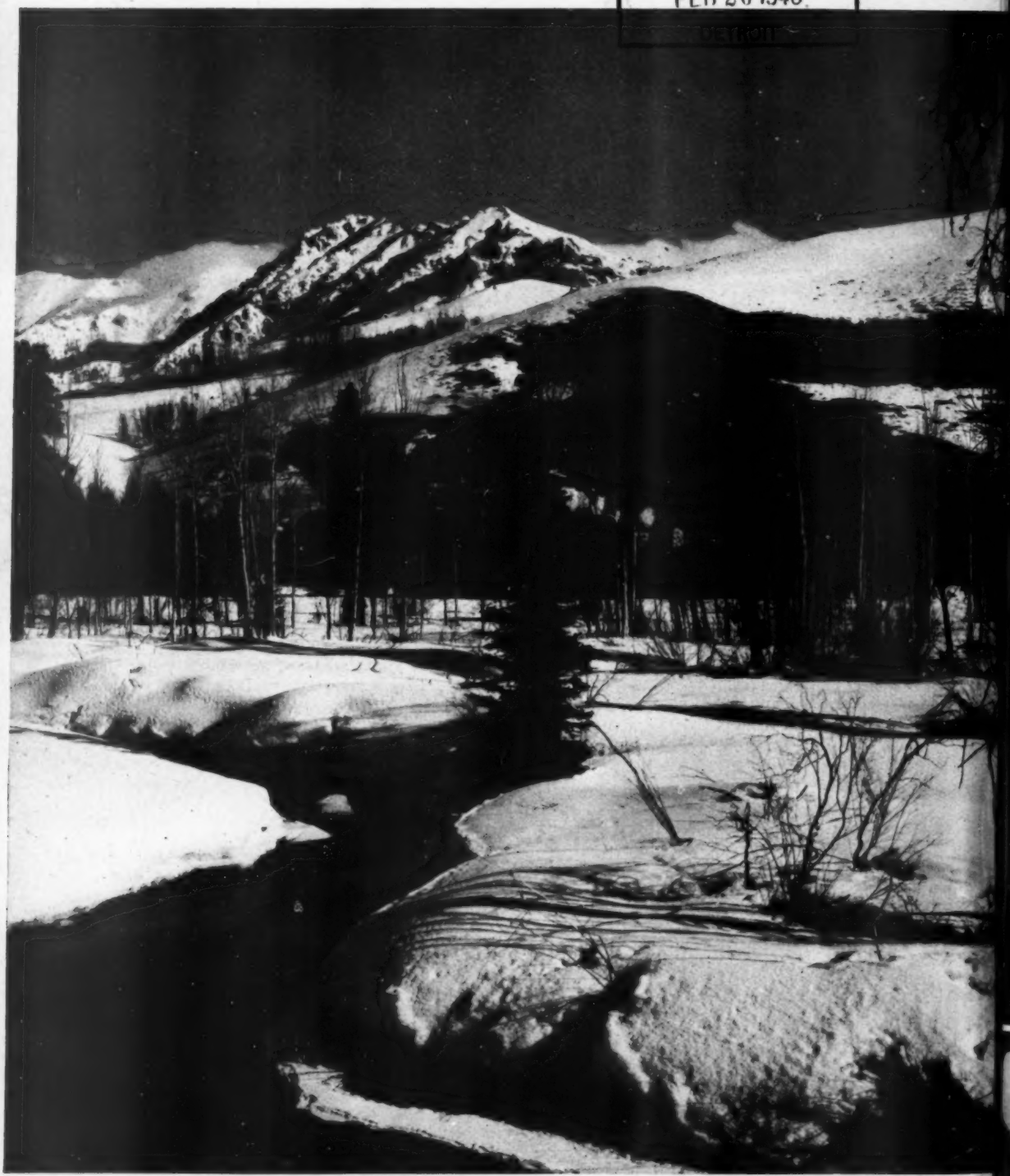
DETROIT



Nature in repose. These snows will melt in a few weeks, replenishing streams and reservoirs, helping to make crops in the valley lands below.

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